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INTERIM FORECASTS OF AGGREGATE

POPULATION, EMPLOYMENT AND

INCOME, 1965 -- 2000

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INTERIM FORECASTS OF AGGREGATE
POPULATION, EMPLOYMENT AND INCOME

1965

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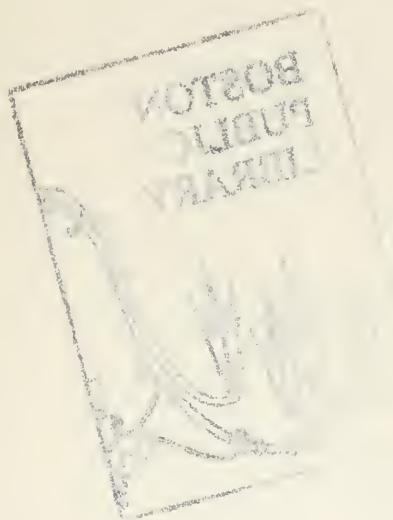
Prepared by
Irving Silver
September 1965

The preparation of this Report was financially aided through a Federal grant from the Urban Renewal Administration of the Housing and Home Finance Agency, under the Urban Planning Assistance Program authorized by Section 701 of the Housing Act of 1954, as amended, and through Highway Planning and Research Funds made available by the U. S. Department of Commerce Bureau of Public Roads.

July 2, 1911

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FOREWORD

This report presents forecasts of population, employment and income for the Planning Area to the year 2000. These forecasts are made with the intention of providing the basis for estimating the scale of future demand for goods and services-- including land, transportation and public facilities. The determination of this demand, and its distribution within the Planning Area are to be performed through the use of statistical models specifically designed for the purpose. The forecast figures contained in this report provide an aggregate total which is then converted to demand and apportioned geographically. This is the primary role of the economic forecasts. In addition, certain plans and studies are being made - principally the Initial Regional Plan, and others will be made in the course of the Project's work, which require the provision of appropriate control figures from which estimates of needs, and the capacity of the regional economy to meet those needs, can be made. In this respect also, the figures contained in this report, and such estimates as are derived from them, are intended to serve as a benchmark for all estimates until such time as more refined forecasts are made.

Several forecasts have been made by others in the recent past which have relevance for the Planning Area. Of these,

CHAPTER II

THE first thing I noticed when I stepped out of the

train was the fresh air and the sound of the wheels on the rails.

It was a relief after the stuffy atmosphere of the city.

The train was moving slowly, and I could see the

scenery clearly. The fields were green and the

trees were tall and leafy. It was a beautiful sight.

I had heard that the country was beautiful, and now I

could see it for myself. The train was moving

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however, none deals precisely with the Planning Area as defined for BRPP purposes; some were made sufficiently long ago that they appear to be invalid in light of subsequent trends; most do not extend to the year 2000; and most either do not possess the degree of refinement or are not sufficiently comprehensive in the categories forecasted to suit present purposes.

Basically, the ratio method has been used in this study. This method entails an examination of the share which the area under study represents of some larger area at several points in time and a projection of the trend in this share to the forecast date. For the Planning Area, it was found that between 1950 and 1960 population and employment increased slightly, by about ten and twelve per cent, respectively, the increases being proportionately less than those of Massachusetts, New England and the United States. Planning Area population and employment are expected to increase at about the same rate in the period 1960 to 2000. The forecast is for an increase in both of about fifty per cent for the forty-year time span. Personal income is expected to rise at a faster rate than population, so that average household income will increase by over eighty per cent. Wage and salary income will continue to comprise about two-thirds of the total income.

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FINDINGS

I. POPULATION

Three forecasts have been made for regional population in the period 1965-2000. These three sets of figures are presented in Table 1 and display a range of 1.3 million persons by 2000, from 4.3 million to 5.6 million. The low forecast series is based upon the assumption that the Planning Area's share of state, New England and U. S. population will continue to change in the future at the same rate as it did between 1950 and 1960. The high forecast is based upon an extension of previous employment trends and the assumption that the number of employment opportunities will govern population size. The medium population forecast is simply an average of the high and low forecasts. Past and projected growth trends for the U. S., New England, Massachusetts and the Planning Area are shown in Fig. 1.

a. LOW FORECAST

According to the low forecast, population would increase at an average annual rate of about 0.6 per cent per decade from 3.4 million in 1960 to nearly 4.3 million in 2000, or an increase of somewhat less than 900,000.

CHAPTER I

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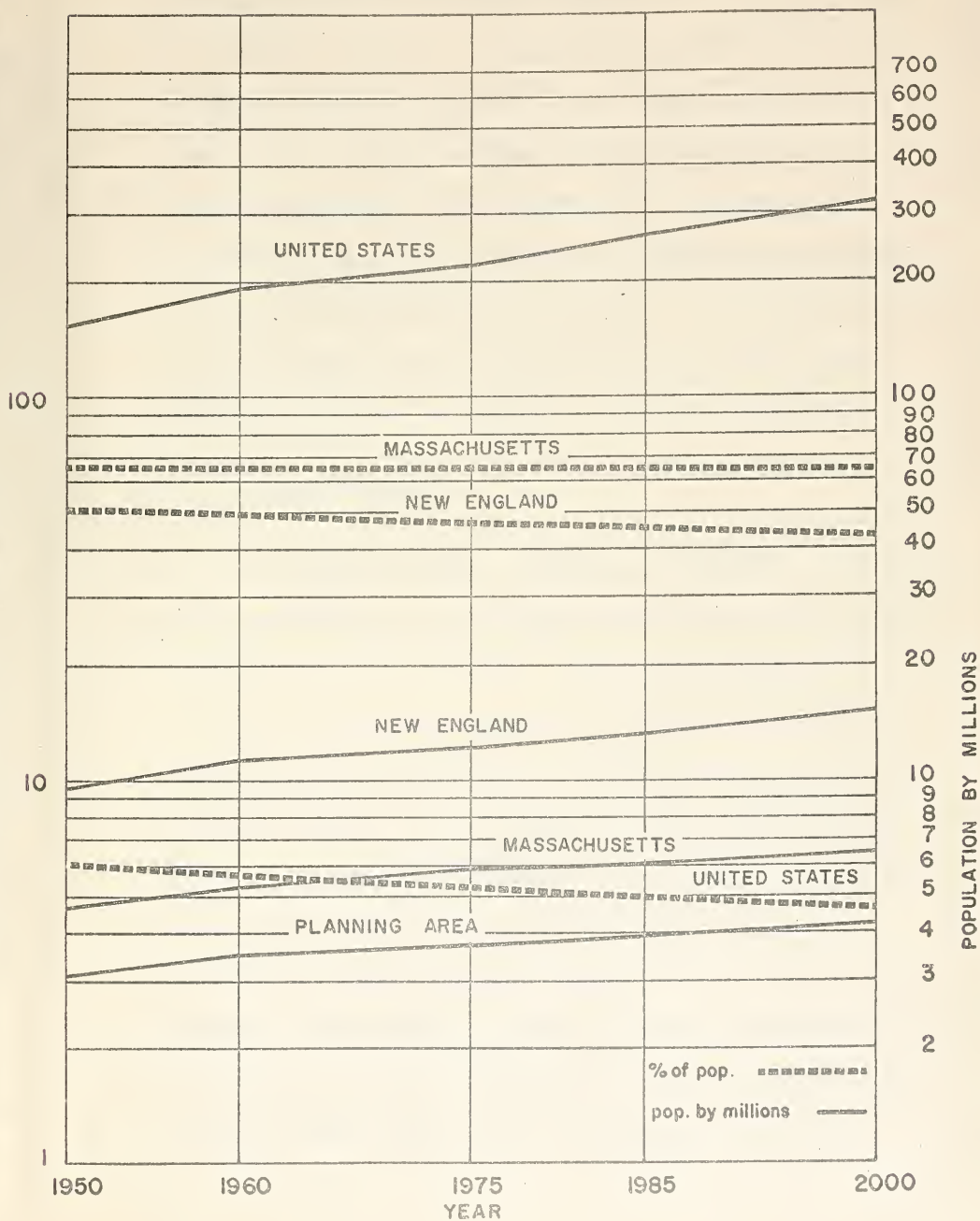
CHAPTER I. OF THE NATURE AND EXTENT OF THE

Table - I
Population, Households and Labor Force, 1950 and 1960
Low, Medium and High Forecasts (000's) to the year 2000
and Index (1960=100)

	1950	1960	1965	1970	1975	1980	1985	1990	1995	2000
Low	Population	3,105	3,402	3,515	3,608	3,714	3,895	3,966	4,065	4,163
	Index	91.3	100.0	103.3	106.1	109.2	114.5	116.6	119.5	122.4
	Households	906	1,008	1,041	1,069	1,100	1,154	1,175	1,204	1,233
	Labor Force	1,358	1,411	1,458	1,497	1,541	1,616	1,645	1,686	1,727
Medium	Population	3,105	3,402	3,597	3,787	3,979	4,183	4,392	4,594	4,836
	Index	91.3	100.0	105.7	111.3	117.0	123.0	129.1	135.0	142.1
	Households	906	1,008	1,066	1,122	1,179	1,240	1,301	1,361	1,433
	Labor Force	1,358	1,411	1,491	1,570	1,651	1,750	1,822	1,905	2,005
High	Population	3,105	3,402	3,681	3,957	4,232	4,501	4,767	4,939	5,223
	Index	91.3	100.0	108.2	116.3	124.4	132.3	140.1	145.2	153.5
	Households	906	1,008	1,091	1,172	1,254	1,333	1,412	1,463	1,547
	Labor Force	1,358	1,411	1,527	1,641	1,755	1,867	1,977	2,049	2,166

POPULATION PROJECTIONS: U.S., New England, Massachusetts and the Planning Area, 1950-2000

% OF POPULATION IN NEXT LARGER AREA



This increase would be proportionately less than that of New England and even slower relative to the nation taken as a whole. Moreover, the projected growth rate is considerably smaller than that of the decades previous to 1960. This forecast assumes the continuation of two principal phenomena: net outmigration from the region to other parts of the country; and a nation-wide decline in the birth-rate manifest since 1960. The low-fertility projection has been incorporated into the most recent national forecasts of the U. S. Bureau of the Census.

b. HIGH FORECAST

The high forecast indicates an increase of 65 per cent, amounting to 2.2 million persons or 1.3 per cent annually from 1960 to 2000. This rate of increase, while it is much more in line with growth previous to 1960, is nevertheless still well behind the forecasted national growth. This forecast is consistent with the high employment forecast of 2.1 million by 2000. (see Appen., Table A-2) which is in turn based upon a national forecast in which continued high fertility is assumed. The two basic national forecasts are therefore inconsistent, and the acceptance of the high population forecast would imply either a reversal of the recent

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downward trend in fertility or a sizeable decrease in outmigration, or both.

c. MEDIUM FORECAST

In the medium forecast, the population figure for 2000 is 5.0 million, a 49 per cent increase over 1960 and an absolute increase of 1.4 million. The growth rate would be 1.0 per cent per year. This forecast series appears to be the most reasonable of the three presented here. As a compromise between demographic and employment projections, it allows for at least two significant departures from past trends: the region's relatively high birth-rate might be expected to fall less rapidly than that of the remainder of the nation, mitigating to some extent the effects of outmigration upon population size in the first decades of the forecast period; and as other parts of the country become relatively less attractive to the mobile sector of the population, migration may itself come much closer to a balance in the later decades. The medium forecast is therefore recommended as a control total for subsequent forecasts of activities by areas within the Planning Area. All of the forecasts which follow in this report are consistent with the medium forecast.

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Assuming average household size remains at the 1960 figure of 3.375 persons over the forecast period, the number of households in the Planning Area will rise from 1.0 million in 1960 to 1.5 million in 2000. The labor force under a similar assumption of a constant relation to population size, would grow from 1.4 million in 1960 to 2.1 million in the year 2000. Because of the assumption of a constant future relationship between population, households and labor force, the indexes of population size included in Table 1 pertain to all three forecasted demographic measures.

II. EMPLOYMENT

The forecast of regional employment by industrial category is presented in Table 2. It shows an increase of about 600,000 between 1960 and 2000, and is consistent with the medium population forecast presented in the previous section. Compared with its growth in the 1950's, employment is expected to grow relatively rapidly in the forecast period. The non-manufacturing industries, which represented two-thirds of total employment in 1960, also account for most of the forecasted growth, with an expected gain of nearly 500,000 or 54 per cent while manufacturing will increase by 165,000 or 39 per cent. Proportional growth of each industry relative to 1960 is presented in the form of

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Table - 2

Employment by Industrial Category, 1950 - 1960 and Forecast to 2000

SIC CATEGORIES	1950	1960	1965	1970	1975	1980	1985	1990	1995	2000
24 Lumber	3800	3400	3480	3360	3600	3611	3611	3611	3611	3611
25 Furniture	6000	5700	5842	5984	6127	6237	6338	6440	6542	6644
32 Stone - Clay	5000	5300	5405	5511	5616	5727	5839	5952	6064	6176
33 Primary Metals	7200	7700	7908	8116	8324	8293	8203	8113	8023	7933
34 Fab. Metals	19700	19800	20286	20772	21258	20973	20495	20017	19533	19060
35 Mach. Exc. El.	32900	39600	43468	47335	51203	51711	51379	51047	50715	50383
36 Elect. Mach.	35600	76000	92951	109901	126852	144982	163408	181833	200258	218683
37 Transp. Equip.	19900	19900	19874	19861	19861	19858	19858	19858	19858	19858
38 Instruments	9000	17000	19750	22500	25250	27352	29292	31232	33173	35113
20 Food	33000	35000	30694	26389	22083	18754	15670	15670	15670	15670
22 Textiles	56300	19900	16171	12443	8714	6284	4180	4180	4180	4180
23 Apparel	30800	30400	30966	31293	31293	31597	32269	32901	32901	33221
26 Paper	13500	16700	17991	19282	20573	21618	22602	23585	24569	25553
27 Printing	26400	27300	27910	28520	29129	29344	29459	29575	29690	29805
28 Chemicals	12200	10300	9358	8415	7473	6238	4930	4930	4930	4930
30 Rubber	15500	20500	23425	26351	29276	32738	36334	39931	43527	47123
31 Leather	53200	48400	44136	41872	39608	37986	36524	35062	33601	32139
* Other Mfg.	17400	19000	18988	18975	18963	19875	21019	22163	23307	24451
15-17 Con. Constr.	49700	55100	60150	65200	70250	70713	70030	70030	70030	70030
40-49 Trans. Comm.	83700	78000	80511	83023	85534	90227	95465	100703	105941	111179
50-59 Trade	263900	280200	292159	304118	316078	334833	352287	375741	396195	416649
Wholesale	44500	74900	78093	81290	84488	89501	94968	100436	105903	111370
Retail	219400	205300	214066	222828	231590	245332	260319	275305	290292	305279
60-67 Fin. Ins. R. Est.	62000	77500	83404	89309	95213	99235	102787	106340	109892	113444
70-89 Services	154500	225600	243780	261960	280140	298433	316755	335077	353399	371721
91-94 Government	140600	154000	165060	176119	187179	201032	215585	230137	244689	259242
Durables	138800	194400	218977	243353	268091	288744	308423	328103	347783	367461
Non-Durables	240900	206500	200383	184268	188149	184559	181968	185516	189068	192621
Other Manufacturing	17400	19000	18988	18975	18963	18875	21019	22163	23307	24451
Total Manufacturing	397100	419900	438348	456596	475203	493178	511410	533782	560158	584533
Non-Manufacturing	75400	870400	925064	979729	1034394	1094473	1155909	1218028	1280146	1342265
Total Non-Ag. Empl.	1151500	1290300	1363412	1436325	1509597	1587651	1667319	1753810	1840304	1926798
Ag. For. Fish. & Mining	9400	11600	11600	11600	11600	11600	11600	11600	11600	11600
Total Employment	1160900	1301900	1375012	1447925	1521197	1599251	1678919	1765410	1851904	1938398

* 19 Ordnance; 21 Tobacco; 29 Petroleum; and 39 Miscellaneous

indexes in Table 3. The preponderance of growth in employment in the Non-Manufacturing sector, representing three-fourths of total growth, is consistent with national trends. Within Manufacturing, the relatively large growth in Durables of 89 per cent as compared with Non-Durables, in which a decline of nearly 7 per cent is anticipated for the Planning Area, is also a reflection of national growth trends.

Among the individual Non-Manufacturing categories, the largest single category of Trade and the second largest category of Services, including both personal and professional, are expected to show the largest gains with about 140,000 employees increase each over their 1960 levels. For Government, the expected increase is 100,000. In terms of rate of growth, Services and Government, with increases of two-thirds above their 1960 size, are outstanding.

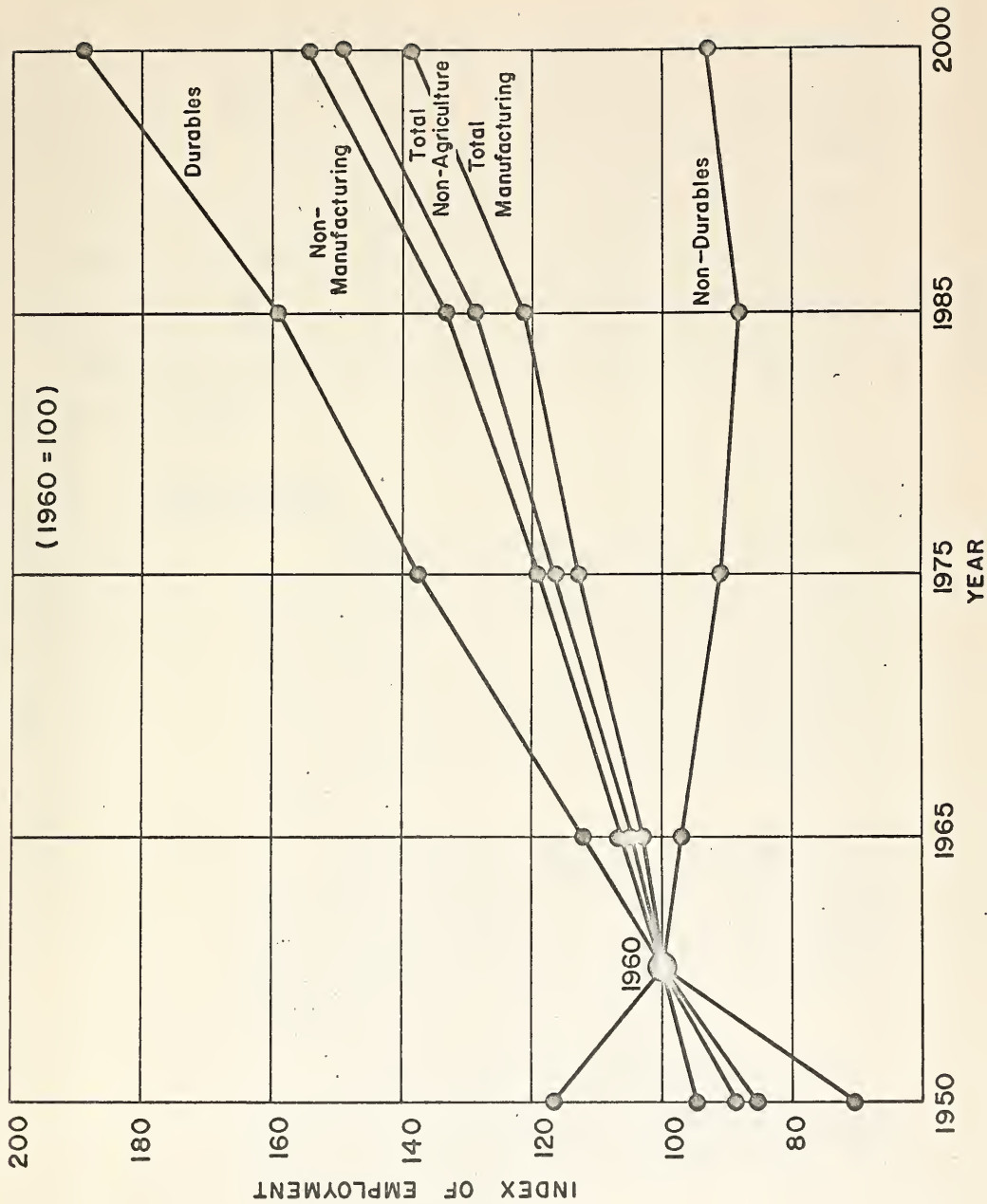
In Manufacturing, Electrical Machinery is outstanding. The industry that doubled in size in the 1950's is expected to triple its employment between 1960 and 2000. The absolute increase of 140,000 makes it equal to Trade and to Services in the number of new jobs created. Instruments, a relatively small category, will show rapid growth, as will Rubber, which includes Plastics. In none of the other Manufacturing categories is anything more than moderate growth expected, and in the categories of Food, Textiles, Chemicals and Leather sharp

Table - 3

Index of Employment by Industrial Category 1950 - 2000
(1960=100)

SIC CATEGORIES	1950	1965	1970	1975	1980	1985	1990	1995	2000
24 Lumber	111.8	102.3	98.8	105.9	106.2	106.2	106.2	106.2	106.2
25 Furniture	105.3	102.5	105.0	107.5	109.4	111.2	113.0	114.8	116.5
32 Stone-Clay	94.3	102.0	104.0	106.0	108.1	110.2	112.3	114.4	116.5
33 Primary Metals	93.5	102.7	105.4	108.1	107.7	106.5	105.4	104.2	103.0
34 Fab. - Metals	99.5	102.5	105.0	107.4	106.0	103.5	101.1	98.7	96.3
35 Mach. Exc. El.	83.1	109.8	119.5	129.3	130.6	129.7	128.9	128.0	127.2
36 Elect. Mach.	46.8	122.3	144.6	166.9	190.8	215.0	239.3	263.5	287.7
37 Trans. Equip.	98.5	99.9	99.9	99.8	99.8	99.8	99.8	99.8	99.8
38 Instruments	52.9	116.2	132.4	148.5	160.9	172.3	183.7	195.1	206.5
20 Food	94.3	87.7	75.4	63.1	53.6	44.7	44.7	44.7	44.7
22 Textiles	283.1	81.3	62.6	43.8	31.6	21.0	21.0	21.0	21.0
23 Apparel	101.3	101.0	102.0	103.0	104.0	106.1	107.2	108.2	109.3
26 Paper	80.8	107.7	115.0	123.2	129.4	135.3	141.2	147.1	153.0
27 Printing	91.7	102.2	104.4	106.7	107.5	107.9	108.3	108.7	109.2
28 Chemicals	118.4	90.9	81.7	72.5	60.6	47.9	47.9	47.9	47.9
30 Rubber	75.6	114.3	128.5	142.8	159.7	177.2	194.7	212.3	229.8
31 Leather	114.6	95.1	90.2	85.4	81.9	78.7	75.6	72.4	69.3
19-21-29-39 Other Mfg.	91.6	100.0	99.8	99.8	104.6	110.6	116.6	122.6	128.7
15-17 Con. Constr.	90.2	109.2	118.3	127.5	128.3	127.1	127.1	127.1	127.1
40-49 Trans. Comm.	107.3	103.2	106.4	109.7	115.6	122.4	129.1	135.8	142.5
50-59 Trade	94.2	104.3	108.5	112.8	119.5	126.8	134.1	141.4	148.7
60-67 Fin. Ins. R. Est.	80.0	107.6	115.2	122.8	128.0	132.6	137.2	141.8	146.4
70-89 Services	68.5	108.1	116.1	124.2	132.3	140.4	148.5	156.6	164.8
91-94 Government	91.3	107.2	114.4	121.5	130.5	140.0	149.4	158.9	168.3
Durables	71.4	112.6	125.2	137.9	148.5	158.7	168.8	178.9	189.1
Non-Durables	116.7	97.1	94.1	91.1	89.4	88.1	89.8	91.6	93.3
Other Mfg.	91.6	99.9	99.9	99.8	104.6	110.6	116.6	122.7	128.7
Total Mfg.	94.6	104.4	108.7	113.2	117.5	121.8	127.6	133.4	139.2
Non-Mfg.	86.7	106.3	112.6	118.8	125.7	132.8	140.0	147.1	154.2
Total Non-Ag. Empl.	89.2	105.7	111.3	117.0	123.1	129.2	135.9	142.6	149.4
Ag. For. Fish. & Mining	81.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Employment	89.2	105.6	111.2	116.8	122.8	129.0	135.6	142.2	148.9

INDEX OF EMPLOYMENT BY INDUSTRIAL SECTOR 1950 TO 2000



declines may be anticipated.

The results presented in Tables 2 and 3 were obtained after the original projections were evaluated by industrial category and, in some instances, were revised to obtain what appeared to be more realistic figures. Growth of the major industrial sectors relative to 1960 is also depicted in Fig. 2. In the following discussion, each of the categories is considered and, where a revision was made, the reasoning is briefly stated.

MANUFACTURING

Lumber and Wood Products - This is a generally declining industry in terms of numbers employed throughout the nation. The Planning Area, with very small numbers employed, has declined relatively less rapidly than Massachusetts. A straight projection would indicate a reversal of this down-trend. Such a reversal, if it occurred, would probably soon level off, hence, the projection indicates a return to a level just above that of 1960.

Furniture and Fixtures - Employment in the Planning Area has declined slightly during the 1950's, but even with a continued declining share of Massachusetts and New England, employment in the Planning Area will increase gradually in absolute numbers as the result of an expected increase nationally.

Stone, Clay and Glass Products - This is an industry with nearly stable employment although higher levels of construction may spur activity in this category. Employment for 2000 in the Planning Area is projected at about 900 above that of 1960.

Primary Metals - The slight increase in regional employment in the 1950's runs counter to the small decline nationally in an industry which has shown short-term rapid fluctuations in the past. A nearly stable employment is forecasted for this generally slow-growing industry.

Fabricated Metals - This industry shows rapid and large fluctuations over time which affect the various areas considered in this analysis at different times and to differing degrees. The basic method is, therefore, not suitable for making projections of this industry. A straight line extrapolation was used, with the result that the industry shows nearly stable employment.

Non-Electrical Machinery - In this industry, the moderate rise in regional employment has been more comparable to national growth than to the trend in the remainder of New England. The anticipated continued slow growth of this industry nationally is reflected in a rise of regional employment to a level approximately 25 per cent above that of 1960.

Electrical Machinery - This industry has grown rapidly, both in the Planning Area and nationally during the 1950's. In New England the increase in employment took place mainly within the Planning Area, while the net increase in Massachusetts as a whole was less than that in the Planning Area, indicating a loss in parts of the state outside the Planning Area. If these trends were to continue, the Planning Area would have all of the Massachusetts employment before 1985; furthermore, all of the increase in New England employment would be in Massachusetts. These developments appear highly unlikely as other parts of Massachusetts and New England are expected to attract the industry and share in its growth. For purposes of the projection, therefore, it was assumed that the distribution of employment in this category as between the Planning Area, the remainder of Massachusetts and the remainder of New England

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would be the same in 1985 as it was in 1960. The forecast made on this basis, nevertheless, yields a substantial increase, a growth of over 100 per cent being forecasted for the Planning Area, due to the dramatic increase forecasted for the nation.

Transportation Equipment - This industry experienced an increase of about 100 per cent in employment in New England in the decade of the 50's due primarily to the booming aircraft industry in Connecticut. An increase of this proportion will probably not be repeated in the future. At the same time, Massachusetts employment suffered a moderate decline due to lessened shipbuilding activity while the Planning Area figure remained almost unchanged. A projection of these diverse relative trends would give misleading results. For the Planning Area, it is fairly safe to assume a nearly stable employment regardless of changes in the total for New England.

Instruments - This is another area of very rapid growth, in which the Planning Area nearly doubled its employment between 1950 and 1960, a still faster growth rate than the United States, New England or Massachusetts; furthermore, the increase in the Planning Area in absolute numbers was greater than the statewide total in Massachusetts, again indicating a loss of employment in other parts of the state. While regional employment continues to grow rapidly, it is unreasonable to expect that all the Massachusetts employment will be concentrated in the Planning Area. Therefore, it was assumed that the share of Massachusetts' employment in the Planning Area in 1960 will also be the share in 1985. This assumption still yields an increase of over 100 per cent between 1960 and 2000.

Food and Kindred Products - The Planning Area has increased its already predominant share of Massachusetts employment in this category even gaining slightly in absolute numbers in an industry otherwise declining in Massachusetts

and New England. Some of the apparent shift of employment into the Planning Area is probably due to statistical re-definition, however. A reasonable assumption about future growth would therefore appear to be that the Planning Area will maintain its 1960 share of Massachusetts. The sharp declines in employment anticipated for New England and Massachusetts thus lead to a forecasted downtrend in Planning Area employment to a level about one-half that of 1960.

Textile Mill Products - Employment in textiles has dropped spectacularly in the Planning Area during the 50's as it has throughout New England and, in lesser proportion, in the country as a whole. The trends of the decade of the 1950's would indicate a loss of all textile employment in New England by 1976. A more realistic assumption, however, would appear to be a levelling off of employment toward the bottom. Such a trend would be represented by setting the ratio of employment in 1985 to that in 1960 equal to the ratio of 1960 employment to that in 1950. The resulting figure for New England employment in 1985 is 53,800, a figure to which trends since 1960 seem to give some confirmation. By applying the established trends in Massachusetts and Planning Area shares to this projection and assuming the 1985 figure to represent the bottom level, we arrive at a figure for 2000 for the Planning Area just above 4,000, or about one-fifth of the 1960 employment.

Apparel - Massachusetts showed an increase in employment during the 1950's but the growth has been mainly outside the Planning Area which actually lost employment. Some growth in this urban-oriented activity appears probable, however, and a small increase is therefore forecasted.

Paper and Allied Products - While national employment is expected to increase, New England's employment will remain stable, with Massachusetts and the Planning Area obtaining increasing shares of the New England figure. Regional employment will therefore continue its upward trend.

Printing, Publishing and Allied Industries -

While the Planning Area is expected to have a declining share of New England employment, the overall growth in this industry will lead to a moderate absolute increase.

Chemicals and Allied Products - New England

just kept pace with the U. S. in the period from 1950 to 1960, but is expected to suffer a relative decline in the future. This is another industry in which economies of scale and proximity to resources which firms can achieve elsewhere place New England at a disadvantage. Because the increase in Massachusetts during the 1950's took place outside the Planning Area, which declined absolutely, the projection indicates the Planning Area as having a very rapidly declining level of employment. This projection is probably too severe; employment in the Boston S.M.S.A., which represents the great bulk of Planning Area employment in this industry, remained almost constant in the period 1958-1963, hence such a radical decline as would initially be forecasted appears unlikely. Planning Area employment figures in absolute numbers were, therefore, extrapolated, yielding nevertheless a decline of about 5,000 before levelling off.

Rubber and Miscellaneous Plastic Products -

Growth will continue strong in this industry, with an increase of 130 per cent forecast to 2000. Much of the growth which apparently took place in the 1950's is due to the inclusion of Plastics in this category in 1958, but, by the same token, Plastics may be expected to contribute to real growth in the future.

Leather and Leather Products - Employment

in New England will continue to be stable, with Massachusetts having a declining share, while other New England states, especially Maine and New Hampshire increase their employment. About half of the state's decline will be in the Planning Area, which will drop by about 14,000 by the year 2000.

THE UNIVERSITY OF CHICAGO
DIVISION OF THE PHYSICAL SCIENCES
DEPARTMENT OF CHEMISTRY
530 SOUTH EAST ASIAN AVENUE
CHICAGO, ILLINOIS 60607-7070

TO THE HONORABLE CHAIRMAN OF THE BOARD OF TRUSTEES
THE UNIVERSITY OF CHICAGO
530 SOUTH EAST ASIAN AVENUE
CHICAGO, ILLINOIS 60607-7070

SIR:

I am writing to you to express my appreciation for the opportunity to work at the University of Chicago. I have been very fortunate to have been able to work with you and your staff, and I have learned a great deal from you and your staff. I am very grateful to you for the opportunity to work at the University of Chicago, and I am very grateful to you for the opportunity to work with you and your staff.

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Yours very truly,
[Signature]

Enclosed are two copies of the letterhead memorandum (LHM) dated and captioned as above. One copy of the LHM is being furnished to the [Name of the Department/Division] for their information and use. The LHM is being furnished to you for your information and use.

Other Manufacturing - (Ordnance, Tobacco, Petroleum and Miscellaneous) The sharp decline in New England's share of national employment during the 1950's was due mainly to the relatively slow growth, as compared to the U. S., in the volatile Ordnance industry. The safest forecast for this entire group, which changed in total employment by only one hundred employees between 1950 and 1960 would appear to be a continuance of its present level.

NON-MANUFACTURING

Agriculture, Forestry, Fishing and Mining - Adjustments in coverage and definition, lack of comparable data for the larger areas, and the application of rather gross adjustment factors in converting covered to total employment make projection of this relatively small category difficult. An extrapolation of the total employment figures of 1950 and 1960 would lead to a sizeable increase which does not seem probable. It was, therefore, decided to set projected employment equal to 1960 employment.

Contract Construction - Planning Area employment increased by about ten per cent in the 1950's, increasing at a faster rate than Massachusetts as a whole, but less than New England. The forecast of an increase to a level of about 70,000 employees is consistent with the expected rise in activity in this category resulting from continued urbanization and renewal of older areas.

Transportation, Communication, Electric, Gas and Sanitary Services - This is an industry in which, largely due to automation, employment has declined nation-wide during the 1950's. Massachusetts and the Planning Area have declined relatively sharply, and although the downward trend is also expected to be reversed generally, the growth rate in the Planning Area will be only moderate.

Wholesale and Retail Trade - The steady growth of this industry is generally consistent with growth in population. Thus, we find a

smaller rate of change during the decade of the 1950's in the figures for the Planning Area as compared with the U. S., New England and Massachusetts. The projected growth rate in Planning Area employment of 4 per cent per decade is therefore less, proportionately than in any of the other areas.

Finance, Insurance and Real Estate - This is an industry in which Boston has traditionally played an important role. While in terms of its share of the U. S., Planning Area employment declined between 1950 and 1960, it nevertheless grew by 25 per cent. The anticipated large growth of the industry nationally due to increasing population and the participation of a larger segment of the population in investment is expected to have its effect upon the Planning Area by increasing its employment by about 46 per cent to 2000.

Services - The Planning Area, in common with New England generally, grew at a slightly faster rate in this category during the 1950's than did the nation as a whole. While limitations of the data used in this study make impossible a more detailed analysis of the region's relatively vigorous growth, it is believed that it is primarily due to the sub-category of professional services including medical, legal and education services, since the region has traditionally been a national center for such services. The growth of this large category, if projected, would consume an overwhelming share of the increase in total employment forecasted for the Planning Area. Since a substantial share of growth in the Services is dependent upon growth in the economy in general, however, it was reasoned that an appropriate method for forecasting employment in this category would be the forecast of its share of a previously-determined total employment figure; thus, Services employment becomes a residual quantity. This method was employed in the forecasts presented here, with the 1960 proportion for the Planning Area being held constant.

Government - This category is expected to continue to grow in numbers employed at about the same rate as in the 1950's. It was necessary to make a departure from the projection method in this case because the apparently slow growth relative to the state, New England and the nation during the base period produced an absolute decline in numbers employed during the forecast period, a trend which appears to be inconsistent with the forecast of a growing population. The relative growth rates of the several areas used for analysis were therefore held constant producing growth for the region of 68 per cent. It may also be noted here that the historical figures for Government employment in the Planning Area are not consistent with the other figures used in the analysis, representing full-time employment only, as contrasted with full and part-time employment taken together, the definition of employment used for the other categories.

III. INCOME

Total personal income is projected from 8.9 billion dollars in 1960 to 24.1 billion dollars in 2000, representing a growth rate of 2.5 per cent annually or a total of 172 per cent between 1960 and 2000. Wage and salary income, which accounts for the largest single source of personal income, is expected to grow at about the same rate, from 6.1 billion dollars in 1960 to 17.4 billion dollars in 2000. Of the gain of over 11 billion dollars in wage and salary income, Manufacturing accounts for about 3.8 billion chiefly in Durables, and Non-Manufacturing about 7.5 billion, Non-Manufacturing income growing at a higher rate than Manufacturing income. These forecasts are presented in tables 4 and 5. In general wage

Table - 4

Wage and Salary Income by Industrial Category, 1950 and 1960 and Forecast to 2000 (\$'000)

SIC CATEGORIES	1950	1960	1965	1970	1975	1980	1985	1990	1995	2000
24 Lumber	14150	14929	16607	16981	12390	20648	21847	23045	24244	25443
25 Furniture	21500	25029	28007	31105	34166	37447	40614	43168	47194	50614
32 Stone-Clay	24380	29409	31808	34278	36818	39476	42204	44160	48000	50859
33 Primary Metals	33070	38733	41509	44370	47330	48962	50227	52015	52631	53778
34 Fab. Metals	81000	106780	122385	138632	155481	16840	176155	189292	192967	200454
35 Mach. Exc. Elect.	14460	208896	248376	291252	337479	363528	383750	406305	423267	442615
36 Elect. Mach.	14130	401597	552222	725127	920311	1146953	1400080	1507439	1978950	2304700
37 Trans. Equip.	98530	133797	150584	167339	184072	200884	217723	234583	251422	268262
38 Instruments	34620	95810	128968	167063	210055	251224	296084	343614	394626	449130
20 Food	126900	176867	173636	165222	151600	140055	126488	135953	145418	154867
22 Textiles	212080	79213	66091	52186	37479	27700	18869	19316	13763	20211
23 Apparel	96530	109539	117819	126216	134779	143482	154117	163241	172566	182018
26 Paper	56560	85476	100426	116579	133930	150764	168114	186369	205544	225633
27 Printing	118460	150087	167544	185609	204311	220638	236379	252245	268249	284340
28 Chemicals	43060	62128	68154	71814	73123	68843	60575	66742	72910	79077
30 Rubber	61570	100346	125464	153284	183795	220654	261641	305951	353570	404504
31 Leather	146300	188220	207881	224560	238282	253329	267465	281490	289943	298346
19-21-29-39 Other Mfg.	57440	110234	133903	157550	181135	214690	253342	294834	339187	386399
15-17 Con. Constr.	213900	325110	402885	488739	582654	642923	692597	748551	804435	860319
40-49 Trans. Comm.	316300	403168	472036	544465	620293	717034	825009	940163	1062694	1192395
50-59 Trade	908600	1121418	1251025	1387082	1530134	1714345	1918550	2133833	2360926	2590956
60-67 Fin. Ins. R. Est.	213800	366374	435452	510401	591178	665172	739758	817861	899467	984580
70-89 Services	437890	914842	1137477	1382101	1648904	1938920	2251178	2586124	2943107	3322814
91-94 Government	584570	811000	906649	1122759	1296963	1504322	1732657	1977337	2237926	2514647
Total Non-Ag.	4168435	6059002	7140908	8307713	9553811	10899594	12335419	13612632	15408903	17355061
01-14 Ag. For. Fish. & Min.	41280	41911	41911	41911	41911	41911	41911	41911	41911	41911
Total Employment	4209715	6100913	7182819	8349624	9595722	10941505	123777330	13654543	15450814	17396972

and salary income tends to rise much more rapidly than employment, because of increasing average wage and salary income. Because of the differential growth in wage and salary income per worker among the individual industries, however, some notable individual projections are obtained. By the year 2000 the Service category is expected to be both the single largest gainer and the single largest category, with 3.3 billion dollars, surpassing Trade, which, although it is expected to contribute 2.6 billion dollars, will show relatively small growth in both employment and in income per worker. Of the other major categories, Government is expected to grow at a higher rate in employment, but at a lower rate in average wage and salary income than the total of all industries, hence its relative position will change little. Electrical Machinery, on the other hand, with relatively large growth both in employment and average earnings, becomes even more prominent among the Manufacturing industries with about 2.3 billion dollars in income in 2000, over half the total for Durables and as great as the income in all Non-Durable industries combined.

Projections of average wage and salary income by industrial category are shown in Table 6. Only one adjustment has been made to the original projections of average wage and salary income which were straight arithmetic extrapolations of 1950 and 1960 data. Average income in the Agriculture, Forestry, Fisheries and Mining category declined during the 1950's and would

Table - 6

Average Wage and Salary Income by Industrial Category, 1950-1960
and Projection to 2000 (Dollars)

SIC CATEGORIES	1950	1960	1965	1970	1975	1980	1985	1990	1995	2000
24 Lumber	3725	4390	4722	5054	5386	5718	6050	6382	6714	7046
25 Furniture	3584	4391	4794	5198	5601	6004	6408	6811	7214	7618
32 Stone - Clay	4877	5549	5885	6220	6556	6892	7228	7563	7899	8235
33 Primary Metals	4593	5030	5249	5467	5686	5904	6123	6341	6560	6779
34 Fab. Metals	4112	5393	6033	6674	7314	7955	8595	9236	9876	10517
35 Mach. Exc. El.	4398	5275	5714	6153	6591	7030	7469	7908	8346	8785
36 Elect. Mach.	3971	5284	5941	6598	7255	7911	8568	9225	9882	10539
37 Transp. Equip.	5027	6723	7572	8420	9268	10116	10964	11813	12661	13509
38 Instruments	3847	5636	6330	7425	8319	9213	10108	11002	11896	12791
20 Food	3846	5053	5657	6261	6865	7468	8072	8676	9280	9883
22 Textiles	3767	3981	4087	4194	4301	4408	4514	4621	4728	4835
23 Apparel	3134	3603	3838	4072	4307	4541	4776	5010	5245	5479
26 Paper	4190	5118	5582	6046	6510	6974	7438	7902	8366	8830
27 Printing	4487	5498	6003	6508	7014	7519	8024	8529	9035	9540
28 Chemicals	3530	6032	7283	8534	9785	11036	12287	13538	14789	16040
30 Rubber	3973	4895	5356	5817	6278	6740	7201	7662	8123	8584
31 Leather	2750	4056	4710	5363	6016	6669	7323	7976	8629	9283
16-21-29-39 Other Mfg.	3301	5802	7052	8302	9552	10802	12053	13303	14553	15803
15-17 Con. Constr.	4304	5900	6698	7496	8294	9092	9890	10689	11487	12285
40-49 Trans. Comm.	3780	5169	5863	6558	7252	7947	8642	9336	10031	10725
50-59 Trade	3443	4002	4282	4561	4841	5120	5400	5679	5959	6238
60-67 Fin. Ins. R. Est.	3739	4727	5221	5715	6209	6703	7197	7691	8185	8679
70-89 Services	2834	4055	4666	5276	5886	6497	7107	7718	8328	8939
91-94 Government	4158	5266	5820	6375	6929	7483	8037	8592	9146	9700

have been unrealistically small for the forecast years. The 1960 average figure was therefore assumed to remain constant. As has been explained under the discussion on employment, this category is a particularly difficult one for which to make predictions. In general it may be stated, however, that the resource based industries, whether in Manufacturing or Non-Manufacturing, are not likely to grow as rapidly in worker income as will the remainder of industries.

Some measure of the effect of a rapidly rising income gradient upon consumers can be obtained from Table 7, which shows that mean personal income per household will climb from \$8784 in 1960 to \$16,061 in 2000, using 1960 constant dollars. This definition includes, besides direct income from wages and salaries, proprietorships, property incomes, both monetary and imputed, transfer payments and social insurance benefits. If that portion of total income devoted to taxes is deducted from total personal income, a figure is obtained for disposable income, or the amount of income actually available for consumption. This figure was \$7774 per household in 1960. Assuming the same proportion of household income paid out in taxes over the forecast period, the figure would be \$14,214 in the year 2000.

As an index of the ability of the region's households to purchase goods and services, the mean household income figure is only a rough guide. The distribution of income among

Table - 7

Personal Income, 1950 and 1960, and Forecast to 2000

	1950	1960	1965	1970	1975	1980	1985	1990	1995	2000
Personal Income (\$ Million)	5,014	8,855	10,365	11,979	13,689	15,450	17,457	19,151	21,549	24,129
Personal Income per Household (\$)	5,534	8,784	9,726	10,675	11,610	12,521	13,416	14,069	15,039	16,061
Disposable Income (\$ Million)	4,498	7,836	9,173	10,602	12,114	13,735	15,450	16,949	19,071	21,354
Disposable Income per Household (\$)	4,965	7,774	8,608	9,447	10,275	11,081	11,873	12,451	13,310	14,214
Household Income Index (1960=100)	63.9	100.0	110.7	121.5	132.2	142.5	152.7	160.2	171.2	182.8

households may also usefully be considered, inasmuch as spending behavior has a strong association with level of income. In Table 8 there is presented a forecast of the numbers of households by income categories. Again, the measure of income is 1960 constant dollars. It can be seen that the bulk of the region's households will move into what are presently the upper income brackets; thus while only 15.4 per cent of households received more than \$15,000 in 1960, 42.1 per cent will be above this point on the income scale in the year 2000. Conversely, the categories below \$5,000 which now contain 20.2 per cent of all households will by 2000 have only 8.9 per cent, although, in total numbers, these categories will still be significant with 133,000 households. The equal numbers of households indicated for the lowest categories result from the forecast method, which distributes that ten per cent of households on the low end of the income scale uniformly among the corresponding bracketed income categories. Changes in numbers of households in six broad income categories are represented in Fig. 3.

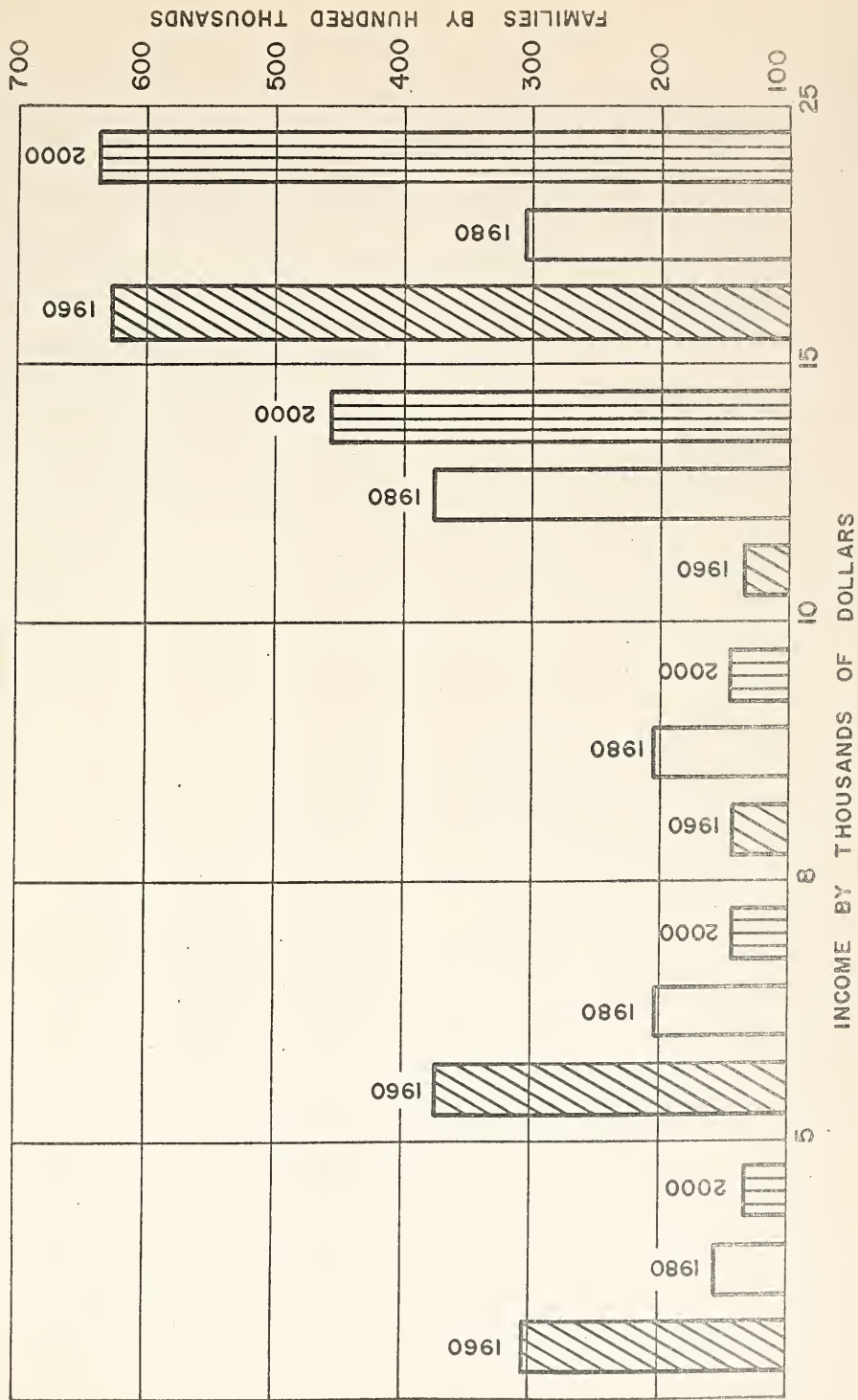
A convenient measure of income distribution, median household income, is also included in Table 8. One-half of all households have incomes above this figure and one-half below. Median income is seen to rise, between 1960 and 2000 from \$6,510 to \$13,575. That each of the set of the median figures is below the corresponding mean figure for that year is a

Table - 8

Distribution of Household Income, and Forecast to 2000 (Dollars)

	1960	1965	1970	1975	1980	1985	1990	1995	2000
Under 1000	23668	31138	29874	28858	28132	27562	27495	27076	26581
1000 - 2000	39048	31138	29874	28858	28132	27562	27495	27076	26581
2000 - 3000	53008	31138	29874	28858	28132	27562	27495	27076	26581
3000 - 4000	76508	48788	37015	28858	28132	27562	27495	27076	26581
4000 - 5000	108013	61703	59198	54763	44532	35110	28822	27076	26581
5000 - 6000	139224	86589	68965	57185	55746	54616	54483	45889	35667
6000 - 7000	123518	108441	88809	80317	65540	54616	54483	53654	35667
7000 - 8000	108406	110067	111472	95148	82187	77843	68717	54601	52673
8000 - 9000	81823	99862	103649	105235	102238	86915	80326	79103	65067
9000 - 10000	59888	86358	93817	98310	100059	103143	99784	84156	77657
10000 - 15000	132526	215420	274024	339026	373464	405860	429760	449295	453145
15000 - 25000	44949	69711	99467	127099	186494	246074	299338	358515	418449
25000 - 45000	17552	85347	96163	106485	116713	126775	135509	172307	214064
Median Income	6518	8221	9023	9813	10583	11340	11892	12711	13575

DISTRIBUTION OF FAMILIES BY INCOME GROUP 1960 TO 2000



consequence of the fact that a majority of the total number of households fell below the mean figure in 1960, or, in other words, that a minority of households in the region received more than half of the total income, and of the assumption that this distribution of household incomes around the mean would remain unchanged over the forecast period.

METHODOLOGY

The forecasts presented in the preceding section deal with three major subjects: population, employment and income. They rely upon future projections of the Planning Area's historical share of national growth in these quantities. The purpose of this section is to describe the method by which the forecasts were obtained. It is intended both to provide the reader with an understanding of the significance and reliability of the findings and to aid other analysts in validating or refining this study for the same or other areas.

GENERAL CONSIDERATIONS

The basic method used in making the projections was the Ratio Method. In this method a series of two or more successively larger geographical areas is selected, each contains the smaller areas in the series. The share which each area possesses of the next larger area of the factor being forecast is measured for points in time and extrapolated to the forecast date. An independent forecast in terms of absolute numbers for the largest area in the series is then multiplied by the share of the next smaller area to obtain a forecast for that area in absolute numbers, etc., until the smallest area is reached. The projections made in this report were based upon just two points in time, 1950 and 1960, with the projection being a straight line extrapolation.

Certain premises are implicit in the use of this method generally, and as applied in this study in particular. First, it is assumed that trends in the relationships among the different areas considered will be gradual and that no radical or discontinuous changes will take place during the forecast period. This is perhaps the single most important underlying assumption. Second, it is assumed that a forecast for a larger area is more reliable than one for a smaller area, since the greater numbers and diversity involved in the larger area make sudden and unexpected changes less likely. Third, it is assumed that the base period is characteristic of long-term trends. Especially where two points in time are used, as in this study, no short-run fluctuations should be present at the base dates which would affect one area differently, and in different degree than it would another. All areas should be at about the same point in any pertinent cycle, e.g., the business cycle, at each of the base dates. It is also desirable, further, that all or both base dates be at about the same point in the cycle.

Considering the foregoing assumptions in the light of the method as it was actually applied in the study, the following points need to be borne in mind. First, the set of areas chosen, viz., the United States, New England, Massachusetts and the Planning Area were such that each area represents a substantial proportion of the larger area which contains it, so that trends

in each of the areas were expected to bear a good relationship to the larger area. In other words, changes in magnitude in an area would have an important influence in changes in the larger total and conversely, changes in the smaller area could be expected to be conditioned, not only by the peculiarities of that area, but to a significant extent by trends in the larger area. Perhaps even more important in this respect in the economic forecast is the fact that the economy of the Planning Area is itself so large and so diverse that expansions and contractions in individual establishments are not sufficient to cause significant anomalous fluctuations. The largest gap in size was between the U. S. and New England which accounted for about six per cent of population and seven per cent of non-agricultural employment in the nation. The absolute size of the New England population and economy, however, makes it suitable for this type of forecast, since the changing relationship of its population and industry to the nation is, by and large, a gradual one. Second, certain assumptions are implicit in the use of the national projections used as bases for the regional forecasts. Growth of national employment by industry was based upon projections made by the National Planning Association which were in turn based upon a U. S. Census projection of population. This population projection foresaw an increase at an average rate of 1.8 per cent per year to 1985, with a slight decline in working age population as a share of the total



population to 1976, then a return to the present share of 70.6 per cent by 1985. N.P.A. therefore projected the labor force to increase at between 1.5 and 1.6 per cent per annum from 1960 to 1985. Gross national product was expected to increase from 500 billion dollars in 1960 to 1,400 billion dollars in 1985, with an average annual rate of growth of about four per cent to 1985.

A more recent set of Census Bureau population projections, however, indicated a substantially smaller future increase, the range running from 1.3 to 1.6 per cent average annual change to 1985, with a mean of 1.5 per cent. This mean forecast, as will be described below, was reconciled with the higher N.P.A. series through a compromise forecast, which would imply a lower growth rate nationally than was forecasted by N.P.A. The effect, however, is that the growth of the individual industries relative to total regional industrial growth remains in most instances the same as would have been forecasted by applying the Ratio Method to the N.P.A. forecasts without modification.

As to the third point, the base period chosen, while it is actually shorter than the forecast period, is nevertheless long enough to cover several short-run cycles, so that in this respect at least it appears to be a reasonable measurement period for projections twenty-five years into the future.

The business cycle, as measured by annual average employment shows peaks approximately in 1953, 1957 and 1960, with lows in 1949, 1954, and 1958. While 1950 is the start of an upturn

and 1960 represents the beginning of a mild downturn, an extrapolation based on the two dates gives a fair indication, however, of the overall trend of the 1950's. This consideration is secondary, however, since, given the national forecast, shares, rather than absolute magnitudes are projected. Of greater importance, however, is that, (at least for New England and the U.S.) the areas appear to be at the same point in the business cycle at each of the base dates. It needs to be pointed out that a major disturbance to the economy took place during 1950, namely, the outbreak of the Korean hostilities in the middle of that year. The perturbation affected the areas under consideration variously as concerns time and magnitude of the upswing, hence, in applying the Ratio Method to the projection of employment by industry it soon became apparent that the use of November figures yielded very misleading results due to the unsettled conditions of the month in 1950. This result indicates a great degree of sensitivity to such fluctuations. The effects of these movements were somewhat "smoothed out" by adjustment of the November figures to annual averages, a procedure considerably easier than determining additional points in time for the base line. The two basic national projections, i.e., those of N.P.A. and the Census Bureau yielded, respectively, a (high) forecast of employment by industry and a (low) population forecast for the Planning Area. The two projections were made similar by first converting the

projected population figures to total employment.

These employment totals were used in making the low set of forecasts by industry presented in Appendix Table A-2. A mean employment forecast was then derived by taking the average between these two sets of employment totals and in effect, using the totals thus derived to scale down the original employment projections by industry. A mean population forecast was derived from this employment forecast by applying an assumed employment population ratio and by further assuming that employment in industries in the Planning Area and employment of residents of the Planning Area are equal, i.e., that inward and outward commutation to employment are equal.

THE METHOD IN DETAIL

A. Population

1. Data on the population size of the United States, New England, Massachusetts and the Planning Area were tabulated for 1950 and 1960.
2. The ratio of each of the four areas (except the U.S.) to its next larger area was calculated for each year.
3. A United States forecast was derived as the mean of four forecast figures for each of the years for which population was to be forecasted for the Planning Area.
4. The changes in the ratios between 1950 and 1960 were extrapolated to 2000 and applied in turn against the independent United States forecast and successive estimates derived from it.

B. Employment

1. Data were tabulated for regional covered employment, as reported by the Mass. Division of Employment Security, by each

of the categories for November 1950 and November 1960. (D.E.S. reports employment by month but does not average the monthly figures over the year). Tabulations were made by metropolitan area and by individual municipality in the remainder of the Planning Area. The one category not covered was Government.

2. Data were tabulated for the United States, New England and Massachusetts for adjusted employment, i.e., both covered and non-covered employment, as reported by the U. S. Bureau of Labor Statistics for non-agricultural industries (including Government) by each category. Annual averages were recorded for 1950 and 1960.

3. Regional covered employment for November was converted to regional adjusted employment for November by category, for 1950 and 1960 by the formula:

$$\begin{array}{lcl} \text{Regional adjusted} & \text{Mass. Adj. empl.} & \\ \text{employment} & = \text{Mass. cov. empl.} & \times \text{Reg'l. cov. empl.} \end{array}$$

In practice, adjusted and covered figures were found to be so close for the manufacturing categories that the figures for covered employment could be taken as equivalent to adjusted, or total employment; but for non-manufacturing, adjustment factors had to be introduced for the categories of Transportation, Communication, Electric, Gas and Sanitary Services (SIC 40-49) and Services (SIC 70-89). The category Agriculture, Forestry, Fisheries and Mining (SIC 01-14) which was not reported by the Bureau of Labor Statistics was arbitrarily given the same adjustment factor as the one applied to Services.

4. Adjusted employment for November was converted to annual average employment. The conversion factors were derived by dividing figures for November employment into annual average employment by category for Massachusetts, 1950 and 1960, as listed in tables supplied by the Bureau of Labor Statistics. The same factors were applied to the Planning Area.

5. Government employment for the Planning Area was added. This information had been developed in a separate study on a municipality basis for purposes of forecasting the distribution of regional activities.

6. Projections of national employment by category to 1976 and 1985 were tabulated. These projections were published in 1962 by the National Planning Association and were in accord with the Census definition of "persons employed". For the

Manufacturing categories, the N.P.A. and B.L.S. for 1960 were found to be virtually identical, hence, the N.P.A. forecast figures could be used directly but for Non-Manufacturing it was necessary to compute the proportional changes, 1960-1976 and 1976-1985 in the N.P.A. figures, and to apply these changes to the B.L.S. data for 1960 to derive the 1976 and 1985 figures. N.P.A. made its forecast as follows: A labor force projection which was derived from a Census Bureau forecast of population was converted to total employment by subtracting servicemen and unemployed; total employment was distributed among industries by analyzing the regression of employment in each industry upon total employment, in most cases over the period 1929-1960 and extrapolating; the first approximation thus obtained being modified on the basis of an examination of each industry with regard to expected changes in the total domestic production of each product or service as affected by the individual consumer, industry and government needs, competition of other products or services, productivity trends and expected technological changes, expected changes in the hours of work, etc.

7. An initial set of projections for 1976 was made by category for New England, Massachusetts and the Planning Area, based upon the national projection.

8. These projections were revised on an industry-by-industry basis where unreliable projections were considered to have been produced.

9. The projection procedure was repeated, using figures for 1960 and the revised 1976 projections as the base years to obtain a 1985 projection.

10. Employment figures for the years between 1960 and 1985 were interpolated and for the years beyond extrapolated, resulting in a set of projections by five-year increment from 1965 to 2000.

11. These projections were reconciled with the population forecast as described in Section C below.

C. Reconciliation of Projections

1. The ratio of employment to population for the Planning Area in 1960 was multiplied by the 1976 (interpolated) and 1985 population forecast figures to obtain employment control totals for those years.

2. Figures for employment by industry for 1976 and 1985 were divided by the ratio of their totals to the control totals, figures for other years then being interpolated and extrapolated to obtain a Low Employment Projection.

3. A mean was taken between the 1976 and 1985 control totals derived in 1. and the employment totals for those years obtained in the High Projection.

4. The new control totals were applied to the employment projection as in 2. to obtain a Mean Employment Projection.

5. The High, Mean and Low projections were revised by inspecting the projections for each category, analyzing them in the light of other employment studies and supplementary statistics and changing the initial projections where such change appeared to be appropriate. The result was a set of three forecasts, High, Medium and Low.

6. High and Medium Population Forecasts were obtained by dividing the totals of the corresponding employment forecasts by the ratio of employment to population derived in 1.

D. Income

1. Annual wage and salary compensation to covered employment paid by industries in the metropolitan areas of the Planning Area was tabulated for 1950 and 1960 by category (except Government). For the remainder of the Planning Area, income was estimated as the product of the annual compensation per covered worker in Massachusetts and the average annual covered employment in the remainder.

2. Total income (covered and non-covered) was estimated by multiplying covered income by the adjustment factor used to convert covered to adjusted employment.

3. Annual compensation in Government was estimated by multiplying the figure published by the U. S. Department of Commerce, Office of Business Economics, National Income Division, for Massachusetts wage and salary income in this category by the ratio of Planning Area to Massachusetts employment.

4. Annual compensation by category for 1950 was converted to 1960 dollars by dividing by the Consumer Price Index for Boston calculated by the Bureau of Labor Statistics.

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5. The annual compensation by category was divided by average annual employment to obtain average annual wage and salary income per employee in 1960 dollars.

6. Average wage and salary income by category was extrapolated to each forecast year.

7. Average wage and salary income was multiplied by forecasted employment by category to obtain wage and salary income by category for each forecast year.

8. Total personal income for the Planning Area was estimated for 1950 and 1960 by multiplying total wage and salary income for the Planning Area by the ratio of total personal income to wage and salary income in Massachusetts for the respective years, based upon published data of the National Income Division.

9. Total personal income for the forecast years was estimated by extrapolating linearly the shares of total personal income represented by wage and salary income in Massachusetts in 1950 and 1960 and multiplying the resulting figures by estimated total wage and salary income in the Planning Area for each of the corresponding years.

10. The proportionate distribution of income by household in the Planning Area in 1960 was approximated by combining the numbers of families and unrelated individuals in each income category in the counties of Essex, Middlesex, Norfolk, Plymouth and Suffolk as reported in the U. S. Census.

11. The number of households in the Planning Area was forecasted by calculating a ratio of persons per household in the five-county area in 1960 and dividing this ratio into the population figure for each forecast year.

12. Mean household income for each forecast year was calculated as the ratio of personal income (from 8.) to number of households (from 9.).

13. Decile figures for the distribution of household incomes in 1960 were calculated (from 9.) with the assumption of a \$45,000 maximum income in 1960.

14. The ratio of each decile to mean household income was computed.

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15. This set of ratios was multiplied by the projected mean household income figures to obtain decile figures for each forecast year.

16. Decile values were apportioned to the original income categories by using the projected number of households and assuming an even distribution of households between decile values.

DATA SOURCES

A. PRIMARY SOURCES

I. Population

The major source of the regional data used in the population projections was the United States Census of Population. For the years 1900 through 1930 the Census figures were obtained from the Massachusetts Department of Commerce and for 1940 through 1960 directly from the Census of Population volumes.

The population figures for 1900 - 1960 for Massachusetts, New England and the United States were obtained from the United States Census of Population as reported in the World Almanac, 1964.

Title of Publication:	Mass. Dept. of Commerce, <u>Statistics of Massachusetts</u> <u>Cities and Towns</u> N.Y. World-Telegram and Sun, <u>World Almanac</u> , 1964 U.S. Bureau of the Census, <u>1960 Census of Population</u> , Part 23, "Massachusetts"
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II. Employment

i. Massachusetts Division of Employment Security - D.E.S. was the principal source of employment data. These data are assembled from quarterly reports of employers who are subject to the Commonwealth's unemployment insurance laws. These reports provide payroll counts of employees for the pay period ending nearest the fifteenth of each month. This series has the great advantage, for purposes of the present study, of a breakdown by municipality, so that an area such as the Planning Area can be precisely

represented. The disadvantage is that not all employment is covered by unemployment insurance, the chief exceptions being government employees, members of the employer's family, non-profit establishments, railroad employees and the self-employed. Data for covered employment were transcribed from tabulations which grouped the figures by the industrial categories used in this study. Data were summarized by metropolitan area plus the individual municipalities in the remainder of the Planning Area.

Form of Data	(Pl. Area) -	Machine tabulations on
or		file at D.E.S.
Title of Publication: (Mass.) -		<u>Employment and Wages for the</u>
		<u>Year 1950, State Summary (mimeo)</u>
		Do., 1960

ii. U. S. Department of Labor, Bureau of Labor Statistics - The figures which B.L.S. publishes are based chiefly on D.E.S. data but include also non-covered employment. A figure for adjusted employment, i.e., total employment, in each category is estimated each month, and the estimates are corrected on the basis of annual complete counts. The figures include Government, but not Agriculture, Forestry or Fisheries. The disadvantage of this data series is that it includes no comprehensive area breakdown below the state level. For our purposes, only Massachusetts and the Boston SMSA (for 1960) were available. With both covered and adjusted figures available for Massachusetts, however, it was possible to derive adjustment factors applicable to the Planning Area. An advantage of the B.L.S. figures over those of D.E.S. is that an annual average figure is included.

Form of Data (Mass. and
 or Boston SMSA)
Title of Publication: (New
 England)
 (U.S.)

Tabulations supplied by B.L.S.
local office
Employment in New England,
1947-1961, 1962
Employment and Earning
Statistics for the United States
1909-62, 1963

iii. Government employment had previously been estimated for the municipalities of the Planning Area in connection with the development of the B.R.P.P. Activity Distribution Model. Estimates were based upon B.L.S. data, the U. S. Census of Governments, Massachusetts County Personnel Board data, the U. S. City and County Data Book and the U. S. Census Compendium of Public Employment.

Form of Data:

Tabulation in B.R.P.P. files

III. Income

i. Massachusetts Division of Employment Security - the quarterly reports referred to above include compensation to covered employment for the entire quarter. The tabulations available at the D.E.S. office give a single figure for total annual compensation.

ii. U. S. Department of Commerce, Office of Business Economics, National Income Division - The National Income Series includes wage and salary income by state and is based chiefly upon unemployment insurance data, supplemented by a variety of sources for individual industries, e.g., the Railroad Retirement Board for railroad income. These data are, therefore, comparable with D.E.S. and B.L.S. data. The series also makes estimates of the other forms of income, so that a total personal income figure is obtained. The National Income data pertain to residents, although they are based upon

establishment data. For Massachusetts it has been assumed by N.I.D. that resident income is equal to compensation made by firms within the state, so no adjustment is made.

Title of Publication: Personal Income by States since 1929, 1956 (for 1950 data).
Survey of Current Business, August, 1963 (for 1960 data)

iii. U. S. Department of Commerce Bureau of the Census - The Census of Population of 1960 listed income by category for families and unrelated individuals. The Census definition of income is not entirely comparable to that of the National Income Division. In addition, it is felt that a bias is introduced by using a sampling procedure to obtain such information as the Bureau does. For estimating the proportional distribution of income, however, the Census figures may be assumed to be adequate.

Title of Publication: 1960 Census of Population (op. cit.)

B. SECONDARY SOURCES

I. Population

U. S. Bureau of the Census - A set of four projections of national population was published in 1964. These projections were generally lower than previous Census estimates, reflecting the recent decline in fertility. The assumptions behind the projections ranged from a decline in the general fertility rate by 2000 of 114.5 births per 1,000 females in "Series A" to a figure of 83.1 per 1,000 in "Series D". The comparable statistic for 1960 was 119.2 (Estimated). The national forecast used in developing estimated future regional

population was a series of means of the four Census projections for each of the forecast years.

The Census Bureau more recently published a series of state projections which are consistent with Series "B" and "D" of the national projections.

A further variable built into the state projections was interstate migration. The Series I projection is derived from an assumption that past gross interstate migration patterns will continue into the future. Under Series II it is assumed that "State migration differentials will gradually be reduced..... Thus providing ultimately zero net interstate migration for each state".

Title of Publication:

U. S. Bureau of the Census,
Current Population Reports
Series P-25, Nos. 286 August, 1964
and 301, February, 1965

II. Employment

i. National Planning Association - The National Planning has published forecasts to 1985 for the U. S. and to 1976 for New England and Massachusetts by essentially the same set of industrial categories as has been used in the present study. The N.P.A. forecasts of national employment have been discussed under the section on Methodology in connection with their use as the basis for the B.R.P.P. projections. Projections by state were made in much the same manner as those for the U. S., past trends in each industry's employment in relation to total employment

being analyzed by regression techniques and extrapolated, then revised according to the facets of demand and technology affecting the particular state. Employment figures of the N.P.A. are not directly comparable with the figures of this study, which are based upon the B.L.S. definition of wage and salary workers, inasmuch as N.P.A. follows the Census Bureau definition of "persons employed", which, on the one hand, does not double count workers with more than one job, as does B.L.S., but, on the other hand, includes proprietors, self-employed, unpaid family workers and domestic servants. The N.P.A. series is probably the most comprehensive in terms of industrial category detail, range of geographic areas and length of the forecast period, of any recent set of forecasts.

Title of Publication: Economic Projections to 1976 and 1985,
National Industry and Metropolitan
Area Indicators

ii. Federal Reserve Bank - In 1959, the Federal Reserve Bank of Boston issued a series of reports containing analyses and forecasts of various aspects of the New England economy to the year 1970. These reports included forecasts of employment in individual manufacturing industries and non-manufacturing industry groups. Manufacturing employment was forecasted, basically by the regression of employment by two digit category upon the U. S. total for the respective industry for points in time over the period 1919-1957, with projections to 1970 being obtained by applying the regression equations to projections of national employment made by the Bureau of Labor Statistics. The projections appear in a number of cases

to be very wide of the mark, if compared with actual employment in 1963, as reported by the Bureau of Labor Statistics. These projections appear to be on the high side for Manufacturing, but rather too low for Non-Manufacturing. While the forecast date falls short of 1985, the discussions included in the analyses were of great value in appraising the prospects for employment in the various industries.

Titles of Publications: Annual Report, 1959, 1960
 New England Research Reports,
 18 V. (mimeo), 1959

iii. Greater Boston Economic Study Committee - In its report G.B.E.S.C. used D.E.S. data to forecast employment, based upon the Federal Reserve Bank forecasts for New England. The ratio method was used for projections to 1970; these trends were then extrapolated to 1980. Since the area covered is almost identical with the Planning Area, these forecasts were of special value for comparison.

Title of Publication: Industrial Land Needs through
 1980, 1962

III. Income

Federal Reserve Bank - "New England's Personal Income Projected to 1970", by Edwin F. Estle, is a report which is part of the series referred to above.

A P P E N D I X

Table -A-1
Projected Populations of the Planning Area, Massachusetts and
New England and Comparison with Forecast of U.S. Population,
1950-2000

Year	United States	New England		Massachusetts		Planning Area	
		Population	% of U.S.	Population	% of N.E.	Population	% of Mass.
1950	152,271,000	9,314,453	6.12	4,690,514	50.36	3,105,144	66.20
1960	180,676,000	10,509,367	5.82	5,148,578	48.99	3,402,473	66.08
1965	194,516,000	11,029,000	5.67	5,327,000	48.30	3,515,000	66.02
1970	208,106,000	11,487,000	5.52	5,470,000	47.62	3,608,000	65.96
1975	223,818,000	12,019,000	5.37	5,636,000	46.93	3,714,000	65.90
1980	241,746,000	12,599,000	5.22	5,920,000	46.25	3,895,000	65.84
1985	260,978,000	13,233,000	5.07	6,029,000	45.56	3,966,000	65.78
1990	280,761,000	13,813,000	4.92	6,188,000	44.87	4,065,000	65.72
1995	301,745,000	14,393,000	4.77	6,347,000	44.19	4,163,000	65.66
2000	324,896,000	15,010,000	4.62	6,529,000	43.50	4,283,000	65.60

Table - A-2
Employment to 2000 by Industrial Category, High Forecast

SIC	1950	1960	1965	1970	1975	1980	1985	1990	1995	2000
24	3800	3400	3520	3640	3760	3800	3800	3800	3800	3800
25	6000	5700	5973	6245	6518	6714	6890	7066	7243	7419
32	5000	5750	5974	6167	6352	6537	6722	6906	7082	7267
33	7200	7700	8085	8470	8856	8911	8883	8856	8829	8800
34	19700	19800	20739	21677	22616	22582	22306	22030	21754	21478
35	32900	39600	44569	49538	54508	55462	55413	55364	55266	55115
36	35600	76000	95711	115422	135133	156275	177774	199273	220772	242270
37	19600	19900	20308	20716	21123	21205	21205	21205	21205	21205
38	9000	17000	20297	23593	26890	29468	31667	34266	36665	39064
20	33000	35000	31144	27288	23433	20166	17047	17047	17047	17047
22	56300	19900	16340	12780	9221	6800	4664	4664	4664	4664
23	30800	30400	31362	32325	33287	33576	33658	33820	33941	34063
26	13500	16700	18432	20165	21897	23212	24421	25631	26841	28050
27	26400	27300	28530	29759	30989	31641	32149	32656	33164	33671
28	12200	10300	9512	8724	7936	6822	5627	5627	5627	5627
30	15500	20500	24058	27616	31175	35145	39219	43293	47366	51440
31	53200	46400	44966	43532	42098	40810	39559	38307	37056	35805
19-21-29-39	17400	19000	19389	19779	20168	21411	22867	24323	25780	27236
15-17	49700	55100	61660	68220	74781	76040	75974	75974	75974	75974
40-49	83700	78000	82335	86670	91005	97083	103598	110112	116627	123141
50-59	263900	280200	298909	317618	336326	361213	387644	414074	440505	466936
60-67	62000	77500	85447	93395	101342	107022	112136	117249	122363	127476
70-89	154500	225600	249794	273988	298183	320855	343147	365439	387731	410024
91-94	140600	154000	169074	184147	199221	216592	234538	252484	270430	288376
Non-Ag- Empl.	1151500	1289300	1395679	1501057	1606440	1708972	1810778	1876689	1985011	2135738
OT-14	9400	11600	11600	11600	11600	11600	11600	11600	11600	11600
Total Empl.	1160900	1300900	1407279	1512657	1618040	1720572	1822378	1888287	1996611	2147338

Table-A-3

Employment to 2000 by Industrial Category, Low Forecast

[illegible]

Table-A-4

Decile Values of Household Income, 1960-2000 (Dollars)

	1960	1965	1970	1975	1980	1985	1990	1995	2000
1	2714	3423	3756	4085	4406	4721	4951	5292	5652
2	4083	5150	5652	6147	6630	7103	7449	7963	8504
3	5012	6321	6938	7546	8138	8719	9144	9774	10438
4	5736	7234	7940	8636	9313	9979	10465	11186	11946
5	6518	8221	9023	9813	10583	11340	11892	12711	13575
6	7385	9313	10222	11117	11990	12847	13472	14401	15379
7	8425	10625	11662	12683	13678	14656	15369	16429	17545
8	9895	12479	13697	14896	16065	17213	18051	19296	20607
9	13563	17105	18774	20418	22020	23594	24743	26448	28246
10	45000	56751	62289	67745	73060	78283	82093	87753	93716

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EASTERN MASS. REGIONAL PLANNING
PROJECT

INTERN FORECASTS OF AGGREGATE POP-
ULATION EMPLOYMENT AND INCOME

DATE

ISSUED TO

